

GUS - 0109  
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13 February 1959

**MEMORANDUM FOR THE RECORD**

**SUBJECT: Supersonic In-Flight Refueling**

1. On 5 February 1959 a meeting was held with Mr. Johnson, LAC, at Burbank to discuss the feasibility of supersonic in-flight refueling of the proposed A7-2 configuration. A preliminary look at the problem at ONI/US Headquarters showed the boom required for such an operation to be 80 to 90 feet long, some 8 inches in diameter, weigh 12,000 pounds and have a drag factor of 1/2 that of the basic aircraft.
2. The length of the refueling boom is dictated, primarily, by two flight parameters. The "receiver" aircraft must be low enough to keep the horizontal stabilizer out of the "lead" aircraft jet wake, and far enough to the rear to keep the nose of the "receiver" behind the nose shock cone of the tanker. Assuming the pivot position of the boom to be at the mid point of the tanker, the necessary boom length is approximately 85 feet long. Mr. Johnson does not believe that boom lengths longer than 10 feet should be considered for operational utilization.
3. Mr. Johnson, without a detailed study, does believe it is feasible to do supersonic refueling at approximately 80,000 feet. This altitude loss would permit the necessary relative movements of the two aircraft. A method of fuel transfer different from the conventional boom system might offer a solution. One such idea proffered was a boom extended laterally from the tanker wing tip to the wing tip of the receiver. Such a proposal could not be done on the A7-3, however, due to the wing tip engine installation. It would be quite expensive to conduct any test program to prove such theories.
4. Mr. Johnson does not visualize the shock cone of the tanker aircraft to present too difficult a pitching moment problem due to the reduced density at the altitudes in question. Such a problem would not exist if the wing tip boom method were employed. (This method would present its own problem, however, one of the biggest being the inability of the pilot to have a good view of the boom due to the aircraft geometry.)

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5. Although Mr. Johnson believes that in-flight refueling at supersonic speeds is feasible, he does not believe that it is operationally practical under the stipulation that the refueling be accomplished prior to penetration of the denied territory. As mentioned above, the refueling would have to be accomplished at approximately 80,000 feet. Thus, only the fuel used during take-off and the climb to 80,000 feet would be replaced. The added weight of the fuel would prevent penetration at 90,000 feet. The increase in range obtained by this method would not justify the expenditure and complexity. The same range with the lower penetration altitude could be obtained by increasing the fuel capacity on the ground and thus eliminating the air operational problem.

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6. A short discussion on the general aspects of supersonic in-flight refueling was held with personnel at [REDACTED]. They have done some studies on the problem but do not have wind tunnel data reduced to useable form. Their approach (presently) is to use a combination boom and flexible hose with a drouge. The probe of the receiver must be high enough to be out of the receiver aircraft shock cone pattern and the receiver aircraft must be completely in the shock cone of the tanker. In addition, they allow sufficient aircraft clearance distance to avoid mid-air collision in the event of control system failure of either plane. Their present boom configuration of stainless steel is about twenty feet long, diamond in cross section with the minor diagonal of 30 inches and the major diagonal 40 inches. Such size is prohibitive for A7-3 considerations.

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